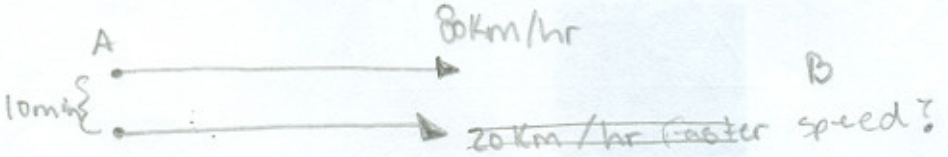
dec 2001

Question 1

A seismic survey truck leaves Point A and travels at a constant speed of 80 km/hr toward Point B. Ten minutes later the survey crew supervisor leaves Point A and drives toward Point B in a light pick-up truck following the same route as the survey truck.

a) How long must the supervisor drive after leaving Point A before overtaking the survey truck if he/she travels at a constant speed that is 20 km/hr faster than the survey truck. At what distance travelled from Point A will the supervisor overtake the survey truck.

b) At would constant speed would the supervisor have to drive if he/she wanted to catch up to the survey truck 25 minutes after leaving Point A.



$10\text{ min} \times \frac{1\text{hour}}{60\text{min}} = .167\text{ h}$

Survey: 80 km/h Sup: 100 km/h

left 10 min

.167 hrs

Distance $80\,(.167)\text{hr} + 80(x) = 100\text{ km/h}\,(x)$

$13.3\text{ km} = 20(x)$

$.66\text{ hr} = x$

52.8 + 66.16 66.66

in = 40 minutes

$80(.4166)\text{h} = x(\text{km/h})$

ahead

~~$80\text{ km/h}\,(.4166\text{h}) + 80\text{ k/m} = x(\text{km/h})$~~

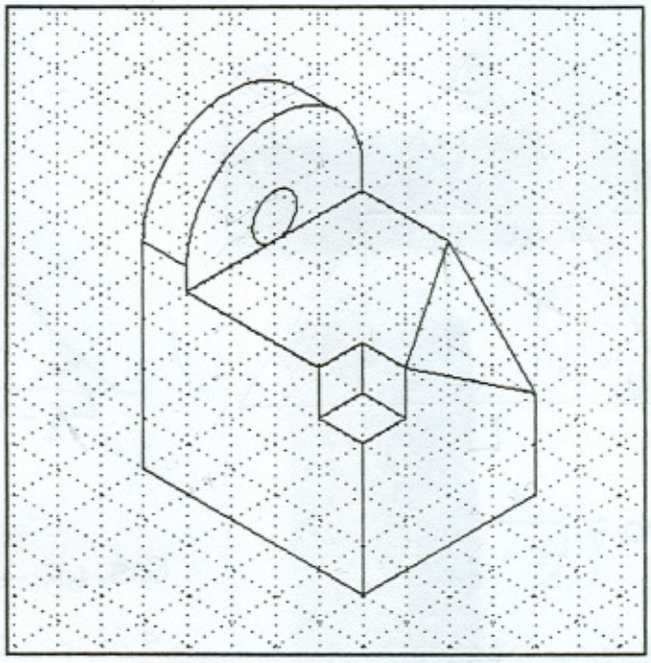
$80\text{km/h}\,(.167)\text{hr} + 80(.4166) = x(\text{km/h})(.4166)\text{h}$

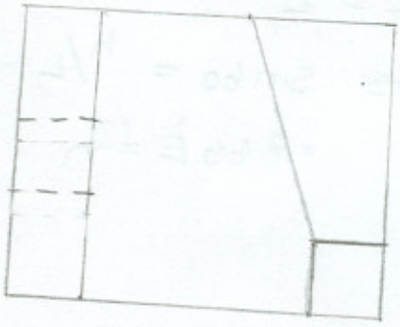
$13.36\text{ km} + 33.33\text{ km}$

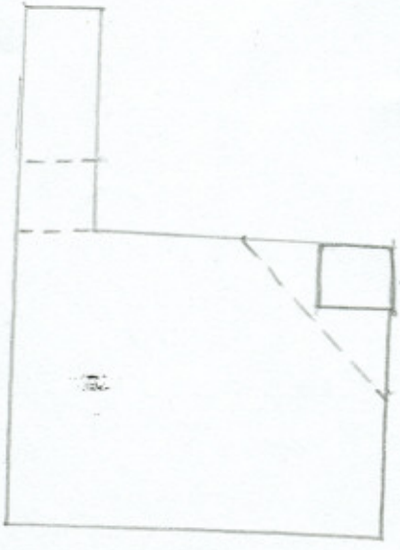
112.1 km/h.

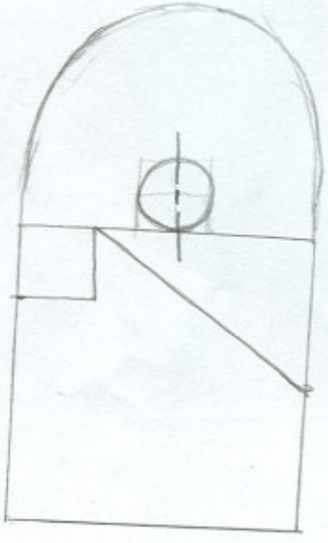
Question 2

For the object shown in the Isometric view below, SKETCH, approximately to scale, the 3 standard Orthographic Views.



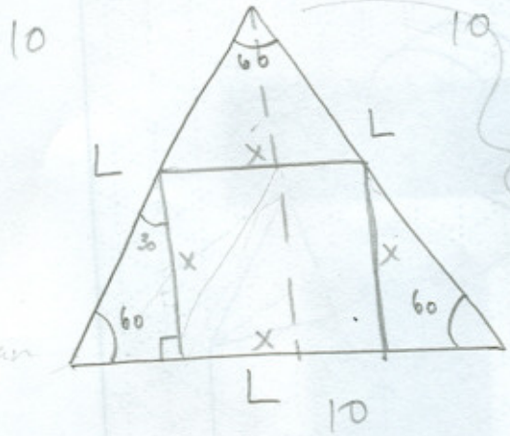


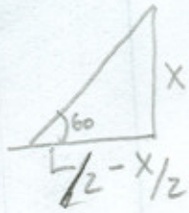




Question 3

A square is placed in an equilateral triangle so that the base of the square touches the base of the triangle. What is the length of the side of the largest such square that can fit in an equilateral triangle of side = L mm?





SohCahToa

$L/2 - X/2$

Tan 60

$\tan 60 = \frac{X}{(\frac{L}{2} - \frac{X}{2})}$

$\cos 60 = \frac{L/2}{L}$

$.866L - .866X = X$

$.5L = L/2$

$.866L = 1.866X$

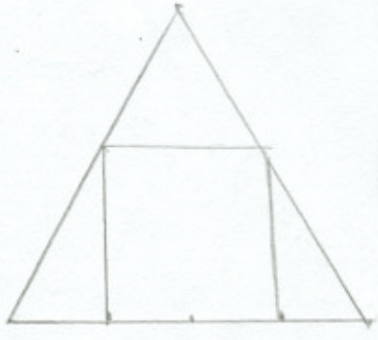
$L = L$

$X = .464L$

$\sin 60 = h/L$

$.866L = h$

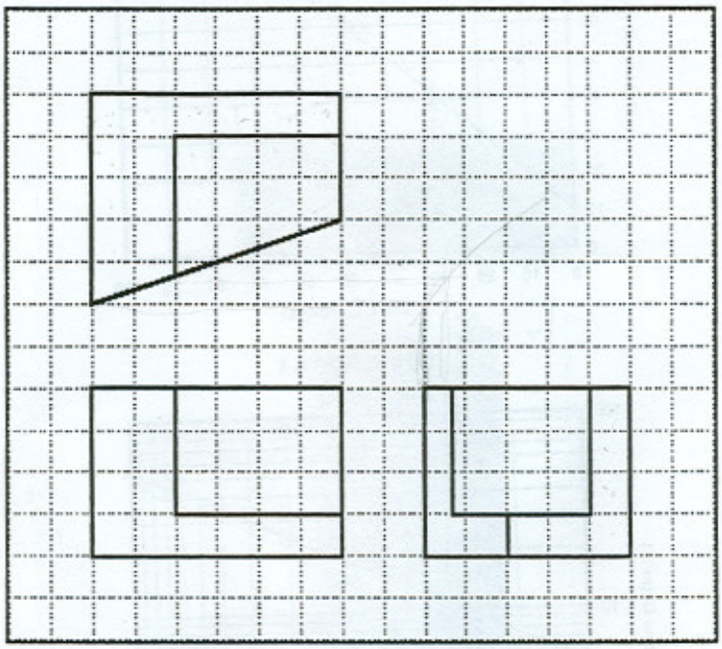
4.64

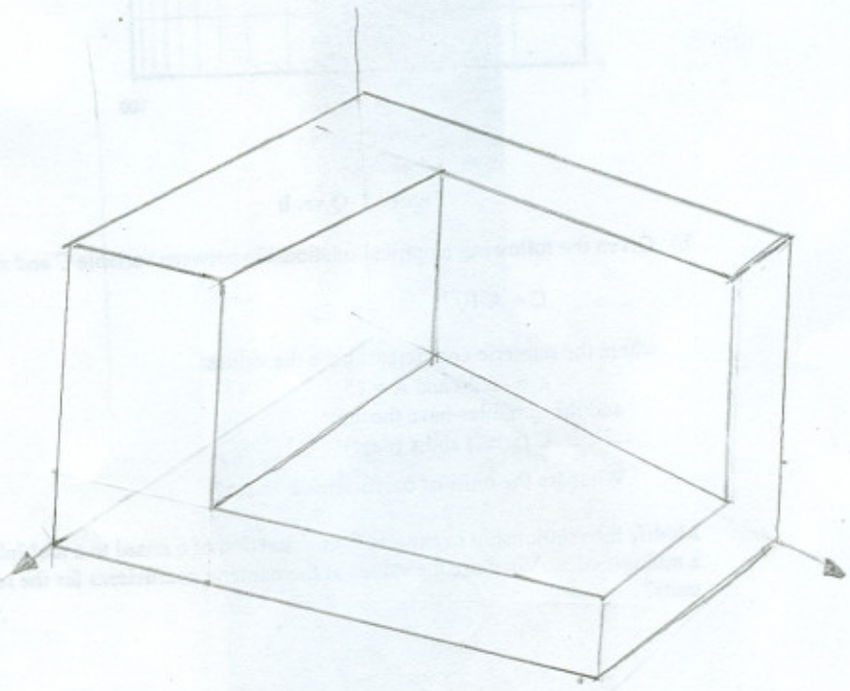


2.32/2.

Question 4

For the object shown below in Orthographic View, SKETCH the Isometric View, approximately double the scale shown.





a) Given the data plots shown in Figures 1 and 2 determine the best-fit empirical relationship between the dependent and independent variable. Determine the numeric value and the units associated with each coefficient used in the empirical relationship for each data set.

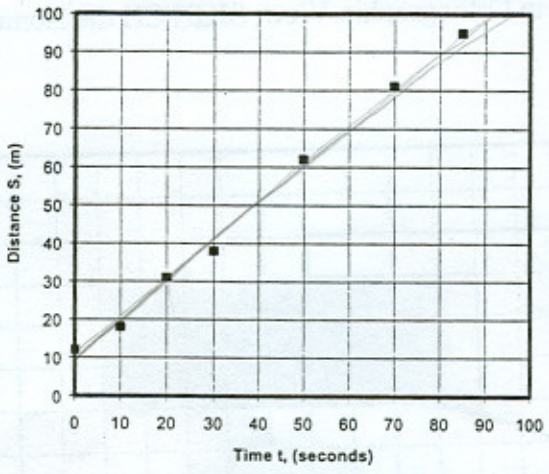


Figure 1 S vs. t

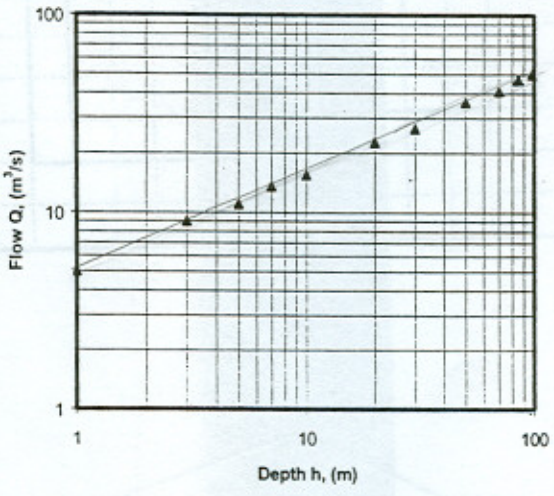


Figure 2 Q vs. h

b) Given the following empirical relationship between variable C and x:

$$C = A\ 10^{kx}$$

where the numeric coefficients have the values:

$k = -0.20$ and $A = 25$

and the variables have the units:

C (g/m^3) and x (days)

What are the units of coefficients k and A?

Modify the relationship to express C as a function of e raised to a multiple of x, rather than 10 raised to a multiple of x. What are the values of the numeric coefficients for the revised relationship and their units?

Question 6

Contour and gradient calculations

Given the topographic map shown in Figure 3 with scale of 1:10,000.

a) What is the difference in elevation between Point A and Point B?

b) What is the average gradient (rise/run) of the ground surface between Point A and Point B?

c) A road is to be constructed between Point A and Point B. The road will have a constant gradient of -0.015 and begin at the existing ground surface at Point A. What will be the elevation of the road at Point B. What depth of material will have to be excavated or placed at B in order to construct the road?

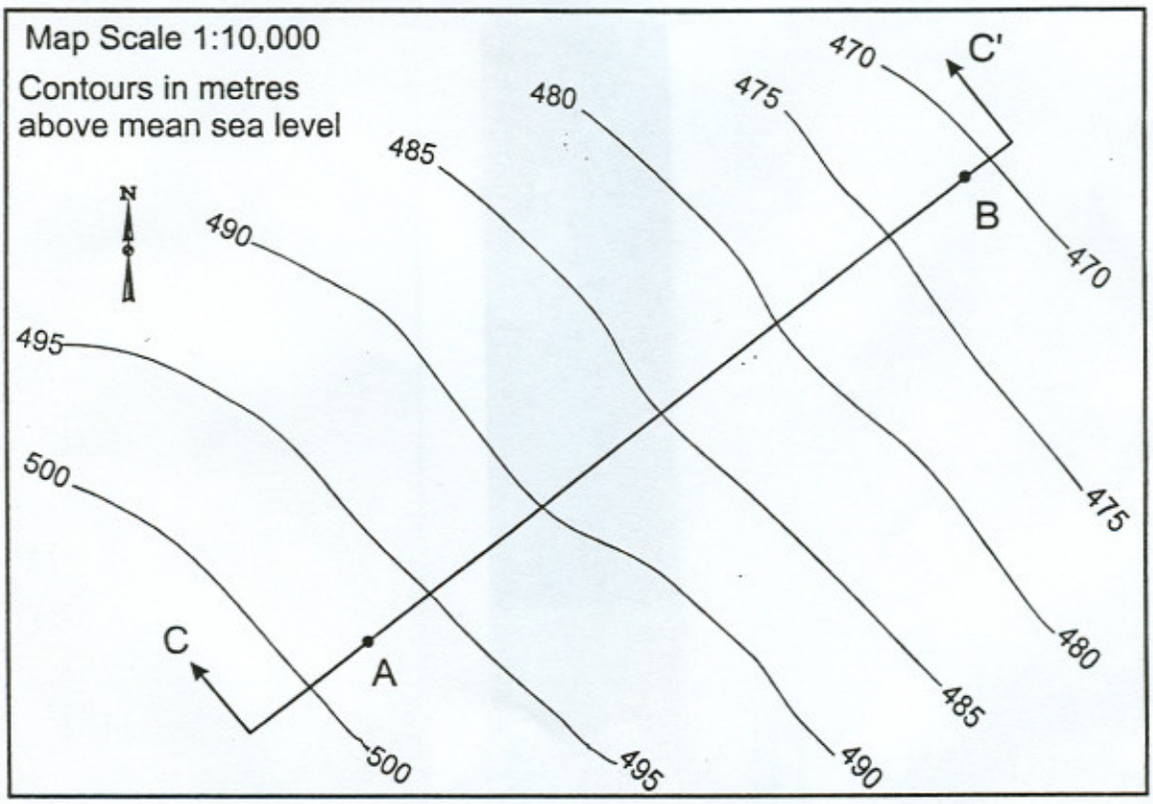
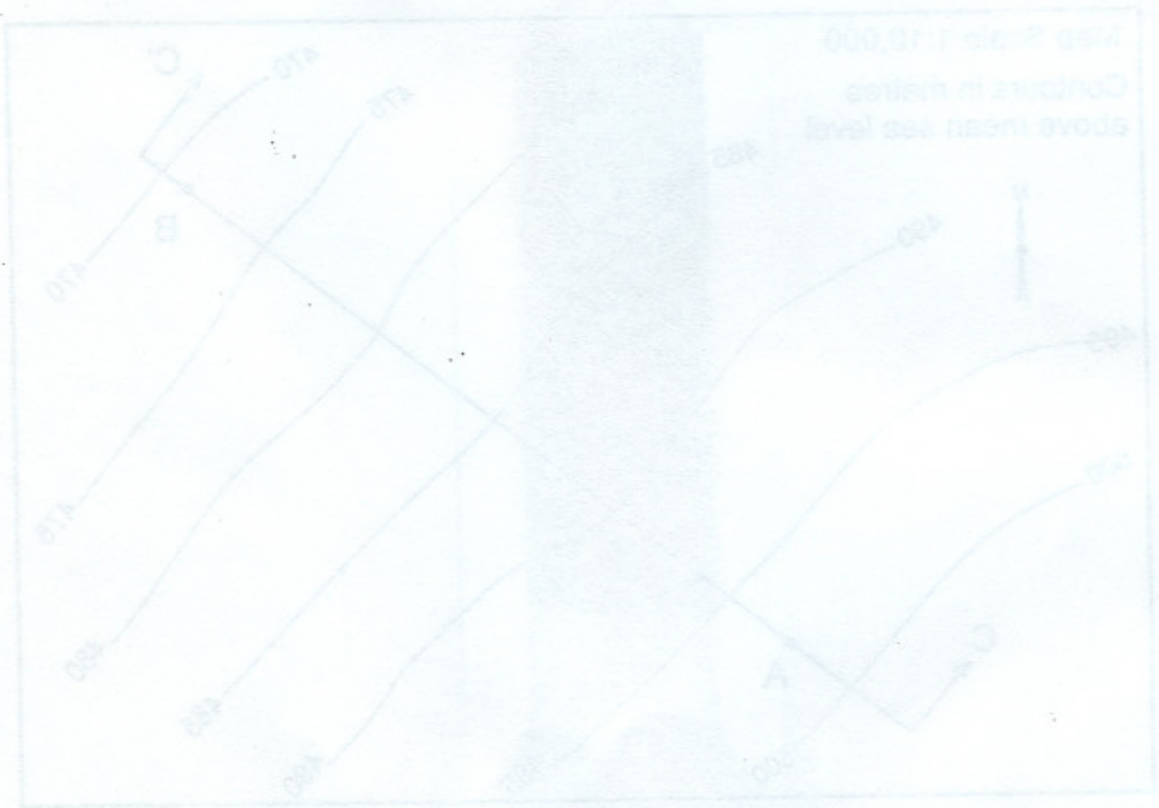


Figure 3 Topographic Map

Question 7

A, B and **C** are a mutually orthogonal set of vectors (each is perpendicular to the other two). The angles that **A** makes with the x, y and z axes are 65.9, 65.9 and 35.3 degrees respectively. It is known that **B** lies in the x-y plane. Determine the unit vector (in the direction) of **C**.



Question 8

In a process to crystallize potash, a saturated stream of dissolved KCl and NaCl in water at 70 °C is fed to an evaporator/cooler at 1000 kg/min. Through the process of evaporation and cooling pure crystalline KCl and NaCl are produced. (See the diagram below.) If the outlet stream is a saturated stream of dissolved KCl and NaCl at 30 °C, determine the rate of evaporation of water, x kg/min, such that the ratio of solid KCl to solid NaCl produced is 2. The saturated stream concentrations (in weight percent) at 70 °C and 30 °C are given in the diagram below.